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THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY

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GAS ABSTRACTS

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1. GAS INDUSTRY

Construction

GAS INDUSTRY CONSTRUCTION BUDGETS. *Gas*, 32, 53-55 (1956) April.

The annual survey of the gas industry construction budgets shows that for 1956 expenditures will total over $1.3 billion for new construction for production, storage, transmission, distribution and general facilities. Transmission expenditures account for over $0.8 billion of the total. The construction budgets of 170 gas companies for the above categories are tabulated. A more detailed account is given of pipeline construction, approved and underway, as well as planned or proposed.

E. J. Pyrcioch

Control and Taxes

TAX DILEMMA FOR GAS PRODUCERS. *Petroleum Week*, 2, 11 (1956) March 9.

The dilemma considered in this short article concerns the following situation: gas producers as members of a unitization plan will now escape federal control, but may then be subject to double taxation—a unit corporation tax as well as their own individual tax. If the producer withdraws from the unit, he is taxed only once, but then will fall under FPC control.

E. B. Shultz

Expansion Capital

Hanley, E. J. FINANCING TOMORROW'S STEEL PLANT DEMANDS: REALISTIC DEPRECIATION AND PRICING POLICY. *J. Metals*, 8, 338-40 (1956) March.

From 1946 to 1956 the steelmaking capacity has grown 40 percent, from 91.9 to 128.4 million net tons. New capacity of 15 million tons is planned in the next 3 years, and with new consumer products requiring new tools, machines and automation, the need for steel is being compounded. New and replacement equipment is not properly provided for financially by the present tax rules on depreciation charges, which are based on original cost, since inflation has raised construction costs from $180 per ton in 1951 to $300 per ton for present new plant. Financially, steel earnings are low, ranking 32nd in earnings, and investors will not be attracted, if the industry retains sufficient earnings to build new equipment. It appears that further cost increases cannot be absorbed, and that steel must be sold at higher prices to provide the attractive profit margins for expansion capital.

O. P. Brysch

Federal Control

IKE'S VETO OPENS PANDORA'S BOX. *Petroleum Week*, 2, 9-11 (1956) February 24.

The impact of the defeat of the gas bill on the gas industry is outlined, as to the immediate future and the long-range outlook.

B. E. Eakin

Fuel Research

Ayres, E. THE IMPORTANCE OF FUEL RESEARCH. *Combustion*, 27, 57-60 (1956) March.

The Age of Fossil Fuels is approaching—not its end, but its culmination. Thus our peak of production of petroleum cannot be later than 1965, though 90 billion bbls remain in the U. S. Likewise the U. S. peaks of production of natural gas and coal cannot be later than 1970, and of world production of all fuels later than 2000. Thus a break with conventional fuel technology that will initiate a capital invention in energy release or in energy conversion required in power generation or automotive transportation is believed to be vital to our development. The 5 percent efficiency of the automobile and the 33 percent efficiency of the best turbines represent the gradual improvements in heat-to-power conversion during a period between capital inventions.

O. P. Brysch

Gas Education

Plank, W. B. ENGINEERING ENROLLMENT REPORT. *Mining Eng.*, 8, 382-83 (1956) April.

A report is made on the current trends in enrollment in engineering schools in the U. S. and Canada. Current enrollments in petroleum and natural gas engineering are as follows: 1032 freshmen, 1125 sophomores, 965 juniors, 726 seniors, and 165 graduate students in a total of 216 colleges. Gas engineers represent a very small percentage of the totals listed.

R. T. Ellington

Patent Licensing

Gray, A. W. PATENT LICENSING. *Machine Design*, 28, 90-92 (1956) April 5.
Terms and limitations of license agreements as defined by statutes and court decisions. Fundamental legal distinctions, license restrictions, limit of control and basis of legal authority are discussed. Author's Abstract

Venezuelan Law

Jones-Parra, J. SOME ASPECTS OF PETROLEUM AND GAS CONSERVATION IN VENEZUELA. *Producers Monthly*, 20, 46-49 (1956) February.
The people of Venezuela derive a considerable proportion of their income from land rights, royalties, and taxes on the oil produced. This tended to make the government consider the maximum production compatible with acceptable conservation practices in formulating their new Law of Hydrocarbons. The various requirements of this law and its effect on the oil industry are reviewed. B. E. Eakin

2. APPLIANCES

Appliance Merchandising

Coburn, A. E. IT'S TIME FOR A CHANGE. *Gas Heat*, 7, 25-7 (1956) April.
The gas industry, at 140, has reached old age without attaining maturity. Antique appliance requirements discourage manufacturers, and stone age merchandising methods kill dealer enthusiasm needed for successful expansion of the market. Author's Abstract

Turner, C. C. COMPUTING SALESMEN'S COMPENSATION. *LP-Gas*, 16, 43-47 (1956) April.
Adequate compensation must be offered sales people if a merchandising organization is to prosper. This second article in the series discusses basic suggestions for compensation designed to automatically direct the salesman to originate his contacts, close his own deals, and minimize trade-ins, price cuts, and the help necessary from supervisors. R. T. Ellington

Burner Design

Reed, R. D. (assigned to John Zink Co.) GAS BURNER FOR WATER WALL FURNACE. U. S. 2,737,234 (1956) March 6.

Conditioner-Sterilizer

DEODORANT-STERILIZER FOR AIR. *Chem. Week*, 78, 46 (1956) March 31.
This article brings out the potential benefit of addition of the deodorization-sterilization function to conditioners. Substantial reduction in size of the unit required for a given space could be achieved by reduction of the amount of outside air make-up. R. T. Ellington

Controls and Ignition

Mohn, H. L. (assigned to York-Shipley, Inc.) SURFACE TYPE BURNER CONTROL. U. S. 2,738,132 (1956) March 13.

Mueller, E. H. RUNNER LIGHTER FOR GAS BURNERS. U. S. 2,737,233 (1956) March 6.

Rafenstein, R. F. (assigned to Milwaukee Gas Specialty Co.) BURNER CONTROL SYSTEM. U. S. 2,736,371 (1956) February 28.

Shaw, B. V., II. FIELD STUDY OF NON-PRIMARY AERATED AUTOMATIC PILOTS FOR COMMERCIAL GAS COOKING EQUIPMENT. Amer. Gas Assoc. Lab. Res. Rept. No. 1253 (1956) February.

The field study of newly developed non-primary aerated automatic pilot installations has shown that when properly installed and used they are satisfactory for commercial gas cooking equipment. Problems remain in properly educating service personnel and users in the characteristics of modern gas equipment, including pilots. Further improvements to permit higher temperature operation of automatic pilot valves are desirable. Author's Abstract

Refrigeration

Berry, N. E. (assigned to Servel, Inc.) CONCENTRATION CONTROL FOR ASBORPTION REFRIGERATING SYSTEM. U. S. 2,738,653 (1956) March 20.

This patent discloses a new method of controlling the concentration of absorbent solution and thus the evaporator temperature in an absorption refrigerating system utilizing water as the refrigerant. J. F. Reed

Space Heaters

Austin, W. F. (assigned to Metromatic Manufacturing Co., Inc.) FORCED FLOW AIR

HEATING AND WATER HEATING FURNACE. U. S. 2,741,242 (1956) April 10.

Kelly, A. E. GAS BURNING FURNACE AND CONTROLS THEREFOR. U. S. 2,741,244 (1956) April 10.

McLane, T. T., McLane, P. R., and McLane, J. A. AIR HEATING FURNACE. U. S. 2,738,785 (1956) March 20.

Water Heating

Brummerhoff, W. (assigned to Johann Vaillant Kommanditgesellschaft, Germany) GAS FIRED STORAGE WATER HEATER. U. S. 2,736,498 (1956) February 28.

Reiter, F. M. DESIGN DATA FOR SERVICE HOT WATER. *Air Cond., Heatg. and Ventil.*, 53, 82-95 (1956) April.

This is the last of a series of three Reference Sections to help the engineer design service hot water systems for commercial and industrial use and, in general, to supply hot water in large quantities. Covered in this section are such topics as economics of hot water utilization, wastes in hot water systems, proper system installation, piping problems and combustion characteristics of fuels used with such systems. Included are a number of graphs for the design engineer and 22 useful tables for reference. Author's Abstract

GAS KEEPS HOWARD JOHNSON RESTAURANTS IN HOT WATER. *LP-Gas*, 16, 66, 68 (1956) April.

207,500 gal. of hot water daily—enough to serve a quarter million customers during an 18-hour day. That's the demand of 89 Howard Johnson restaurants in 10 southern states. The answer —gas water heaters. Editor's Abstract

3. COMBUSTION AND INDUSTRIAL FURNACES

Engine Fuel

Hughes, E. C., Faym, P. S. and Wotring, W. T. BORON COMPOUND LIFTS MOTOR-FUEL OCTANE. *Oil Gas J.*, 54, 121-22, 25, 28, 31 (1956) March.

A boron compound used as a gasoline component effectively reduces surface ignition in gasoline engines without accumulating in the engine. It reduces deposits on hotter areas and thus lengthens exhaust valve life. The boron component increases the F-1 antiknock effect of tetraethyl lead in most gasolines. The effect varies widely with fuel composition. Ratings on the road show the antiknock effects to be better than predicted by the F-1 measurements. The boron component counteracts in part the bad effects of sulfur compounds on TEL. The compound is of low toxicity and easily injected into the gasoline. Authors' Abstract

Flame Research

Neu, J. T. INFRARED SPECTROGRAPHIC STUDIES OF PREFLAME REACTIONS OF n-BUTANE. *J. Phys. Chem.*, 60, 320-24 (1956) March.

The feasibility of using infrared spectrographic techniques to study pre-flame and cool flame reactions was demonstrated. The pre-flame reactions of a fuel-rich mixture of butane and oxygen, yielded mainly oxygenated compounds including formic and acetic acids, formaldehyde, methanol, and carbon mono- and dioxide. Other than the original fuel, the only hydrocarbon observed was methane. After a cool flame, other hydrocarbons were discovered, mainly ethylene. Possible explanations for the presence of these products are presented. S. A. Weil

Sandri, R. ON FLAME PROPAGATION IN EXPLOSIVE MIXTURES OF GASES. I. GENERAL THEORY. II. ON THE DECOMPOSITION FLAME OF OZONE. III. FLAME PROPAGATION IN MIXTURES OF METHONE AND NITROGEN AIR, HELIUM AIR, AND ARGON AIR. *Can. J. Chem.*, 34, 313-337 (1956) March.

A simplified system for the numerical solution of the differential equations of flame propagation is presented. The method yields results close to those obtained by the exact method of Hirschfelder for the decomposition flame of ozone when the same mechanism and temperature dependence of transport properties are assumed. In the application of the method to the combustion of methane, the rate determining step was assumed to be between CH_4 and O with a rate constant as given by collision theory. The resulting calculated values of burning velocities of six flames agreed within 10% of experimental values. S. A. Weil

Fuel Estimating

Strock, C. THE DEGREE-DAY—A FUEL ESTIMATING UNIT. PART II. *Air Cond., Heating Ventilating*, 53, 90-114 (1956) March.

Comprehensive tables of normal degree-day figures by months for 335 cities and yearly totals for 877 additional localities appeared in a Reference Section in the March, 1954, issue. This second section on the degree-day is devoted to 1) an explanation of the use of the degree-day in determining heating plant operating efficiency, 2) a rational method for estimating fuel or energy requirements of a heating plant, 3) tabular data for 413 locations for estimating such requirements, 4) a series of maps graphically showing similar data for the U. S., and 5) degree-day data for Alaska and Dominion of Canada. Author's Abstract

Heat Treatment

Armour, J. D. CONTINUOUS ANNEALING WITH CARBON RESTORATION. *Ind. Gas*, 34, 5-7, 21 (1956) March.

A continuous pusher-tray type controlled atmosphere furnace is used for the continuous large scale annealing of cold drawn rod and wire in coils. Cold forming and automatic machining stock is produced without surface decarburization in this six-zone gas-fired furnace. Author's Abstract

Carlson, H. G. APPLICATION OF ELECTRONIC INDUCTION HEATING EQUIPMENT: PARTS I AND II. *Ind. Heating*, 23, 250-62 February; 490-502 (1956) March.

Many factors of this competitive method of metal heating, such as coil design, power requirements and matching loads to the generator, are discussed. R. T. Ellington

Cullen, O. E. SELECTION AND APPLICATION OF FURNACE ATMOSPHERES FOR CARBON CONTROL. *Metal Progress*, 69, 57-61 (1956) March.

A furnace atmosphere containing about 20% CO, 40% H_2 and 40% N_2 can be used to carburize, carbo-nitride, recarburize decarburized surfaces, clean harden or increase the carbon content of strip to a uniform higher level. Careful measurement and control of the dew point are needed to hold the carbon potential of the gas within the close limits required. Author's Abstract

Schaaber, O. PRODUCTION CONTROL OF SALT BATHS IN GERMANY. *Metal Progress*, 69, 67-71 (1956) March.

Potential of bath is measured by immersing mild steel foil long enough to carburize throughout and estimating its carbon content. Quenching power of martempering bath is measured by time needed to heat a small cylinder through a specified range. Author's Abstract

Industrial Drying

Sundling, R. A. ADVANTAGES OF DIRECT GAS-FIRED SPRAY DRIERS. *Ind. Gas*, 34, 8, 9, 20-21 (1956) March.

Direct gas firing offers substantial advantages, both in initial cost of equipment and in operating costs. Here is a summary of fundamental operations about this process which has wide acceptance in food, industry, and graining in chemicals. Author's Abstract

Industrial Heating

GAS DOES ANOTHER JOB. *National Gas Bull.* (Australia), 20, 11 (1956) February.

Application of Schwank burners to skin drying of casting molds is described. R. T. Ellington

IMPROVING FURNACE PERFORMANCE BY MODEL INVESTIGATION. *Coke and Gas*, (British) 18, 101-03 (1956) March.

Use of a magnetic slurry injected into a container of water is described as giving an upside-down but true model of flame flow in a furnace. R. T. Ellington

Nuclear Process Heat

Graham, R. H. COMING: PROCESS HEAT FROM NUCLEAR REACTORS. *Chem. Eng.*, 63, 191-93 (1956) March.

Uses for nuclear fuel to produce high temperature reactants include coal gasification, acetylene production, and nitrogen fixation. The Bureau of Mines has entered into a joint program with the AEC to develop a synthesis (coal gasification) gas reactor. W. G. Bair

Odor Level Factors

Kerka, W. F. and Humphreys, C. M. TEMPERATURE AND HUMIDITY EFFECT ON ODOR PERCEPTION. *Heating, Piping Air Cond.*, 28, 129-36 (1956) April.

An increase in humidity has a definite effect of lowering the odor-perception level of cigarette smoke as well as pure vapors. Organoleptic appraisals of perception intensities made over a wide range of temperatures and humidities reveal that this effect is more pronounced for some odorants than for others. An increase in temperature at constant specific humidity lowers the odor level of cigarette smoke slightly. The effect of temperature upon the three pure vapors studied is not so consistent. Adaption to odors takes place more rapidly during the initial stages of exposure. While the perceptible odor level of cigarette smoke decreases with time of exposure, irritation to the eyes and nose generally increases. The irritation is greater at low relative humidities (below 35 percent) than above 50 percent. Authors' Abstract

Public Housing Fuels

List, O. F. HEATING AND FUEL REQUIREMENTS IN PUBLIC HOUSING. *Coal-Heat*, 72, 12-16 (1956) March.

The Chicago Housing Authority has completed, or has under construction, 32 housing projects supplying homes for more than 80,000 persons. Of these, 16 projects having 750 residential buildings aggregating 52,592 rooms are heated by coal, of which 75000 tons was required for the current season. Several of the separate projects and their heating, hot water and control systems are described. Diverse sizes of projects and structures require a broad variety of equipment. Dwellings for 7000 persons (36 buildings) are heated by oil and certain newer buildings are using gas heat. O. P. Brysch

Solar Heating

Sporn, P. and Ambrose, E. R. SOLAR HEAT PUMP BEATS HANDICAPS. *Heating, Piping and Air Cond.*, 28, 108-11 (1956) March.

Field tests from 1950 to 1955 exploring practical and suitable solar collector designs for heat pump applications. The results are not conclusive, but are believed sufficient to give a good indication of what can be expected with a solar heat pump design. J. G. Chalcraft

4. CARBONIZATION AND GASIFICATION

Carbon Properties

Walker, P. L., Jr. and Raats, E. EFFECT OF GAS DIFFUSION IN GRAPHITIZED CARBON RODS ON THEIR GASIFICATION RATE WITH CARBON DIOXIDE. *J. Phys. Chem.*, 60, 370-72 (1956) March.

Experimental gasification rates of graphitized carbon rods at temperatures of 970°-1372° C. show a decrease from true values, above 1130° C. It is shown that the rates can be converted to the true values by applying a correction for the internal gaseous diffusion. E. J. Pyrcioch

Walker, P. L., Jr. and Raats, E. CHANGES IN PHYSICAL PROPERTIES OF GRAPHITIZED CARBON RODS UPON GASIFICATION WITH CARBON DIOXIDE. *J. Phys. Chem.*, 60, 364-69 (1956) March.

Changes in surface area, total and incremental pore volume, pore radius, macropore surface area and specific reaction rate for graphitized carbon rods were investigated following gasification to 11.5% - 46.0% burn-offs at 1000° C. and to 11.0% burn-off at 970°-1372° C. Results obtained are explained on the basis of the nature of the carbon rods used, which were composed of non-porous petroleum coke (75%) bound with coal tar pitch (25%).

E. J. Pyrcioch

Carbon Purification

Brooks, L. (assigned to United Carbon Products Co., Inc.) METHOD OF PRODUCING HIGH PURITY GRAPHITE—U.S. 2,734,799; GRAPHITE PURIFICATION—U.S. 2,734,800; METHOD OF REMOVING BORON FROM GRAPHITE—U.S. 2,734,801 (1956) February 14.

The author claims electric furnace methods of removing metallic impurities from amorphous (petroleum coke) carbon,—in the first patent by mixing metallic carbides with the carbon to form the furnace charge, chlorinating at 1000° C. to form graphite nuclei and finishing at 2000° C. in a stream of chlorine; in the second by chlorinating up to 1860° C., then fluorinating to 2100° C., using pure halogens or halogenated hydrocarbons as the agents; and in

the third, heating to 1000° C., injecting dichlorodifluoromethane into the carbon bed, and raising the temperature to 2600° C. to remove boron. O. P. Brysch

Carbonization

THE PRODUCTION OF COKE FROM LOW-RANK COALS. *Coke and Gas* (British), **17**, 471-74 (1955) December.

Production of smokeless fuel and coke from coals of low coking power by the Grancole process is described. In this process the non-coking and slightly coking coals are heated in retorts at 1000° C. The resultant coke is very reactive (reactivity C.A.B.—0.03 cu ft per minute) and contains 84% fixed carbon. It is free burning and has a calorific value (as delivered) of 12,720 B.Th.U. K. C. Channabasappa

Coal Chemicals

Rose, H. J. and Glenn, R. A. COAL, CHEMICAL AND OTHER PROCESS USES. *Ind. Eng. Chem.*, 48, 351-9 (1956) March.

In non-fuel uses, coal is converted into other products by the processes of carbonization, gasification, hydrogenation, oxidation, hydrolysis, combustion and extraction. The major non-fuel use is carbonization, which produces the coke for reduction of ores, and the coal chemicals upon which the aromatic chemicals industry is based. Gasification also produces chemicals, by synthesis from CO and H_2 such as methanol, ammonia, synthetic motor fuels, and oxo-chemicals. Hydrogenation (liquid phase) produces motor fuels aromatics, phenols and LP-gases, besides oils and pitches, although this is not yet used commercially. Oxidation and hydrolysis yield carboxylic acids and phenols, and extraction is used on a small scale to obtain special carbon (ash-free), resins and waxes from coals. Combustion is used primarily in CO_2 manufacture. Carbon for reduction processes is the major chemical use (88% of all coke to blast furnaces) with increasing amounts needed for ferroalloys, aluminum and titanium. Reduction of phosphorus, manufacture of CS_2 and alkali sulfides, calcium carbide and cyanamide, and silicon carbide also require much coal. Based on its physical properties, coal uses include active carbon, cation exchange, graphite and electrode carbons and molding materials. A classified list of 135 references is given.

O. P. Brysch

Coal Hydrogenation

Frese, E. L., Schappert, H. M., Simmat, W. E. (assigned to Koppers Co., Inc.) COAL HYDROGENATION PROCESS. U. S. 2,738,311 (1956) March 13.

This coal hydrogenation process involves a three-step scheme. Liquid phase hydrogenation produces a heavy oil, which is then thermally cracked at 900-1150° F. and pressures up to 100 psi. The middle oil from the coking step is then hydrogenated to gasoline in vapor phase.

E. B. Shultz

Coal Oxidation

Kinney, C. R. and Ockert, K. F. NITRIC ACID OXIDATION OF BITUMINOUS COAL. *Ind. Eng. Chem.*, 48, 327-32 (1956) February.

Bituminous coals where oxidized with hot concentrated nitric acid combine chemically with the elements of nitric acid at low temperatures. Between 70°-100° C., a vigorous oxidation sets in with oxidative cleavage of the linkages holding the macromolecules of the coal together. The resulting product is a mixture of black, nitric-acid soluble humic acids, containing 4% nitrogen, and having an equivalent weight of about 300. With further increase in temperature, the insoluble acids are converted to nitric acid-soluble humic acids, containing 5% nitrogen, which are finally converted to water-soluble acids. It is concluded that the use of nitric acid as a process for manufacturing humic acids from coal is very effective, resulting in more humic acids in 15 minutes than with air at 200° C. in 200 hours as reported previously. K. C. Channabasappa

Coal Plasticity

Fitzgerald, D. THE KINETICS OF COAL CARBONIZATION IN THE PLASTIC STATE. *Faraday Soc. Trans.* (British), 52, 362-69 (1956) March.

Ten British coals, when held at a constant temperature in the plastic range (using a Gieseler-type ASTM plastometer) each showed a plot of fluidity against time which passes through a maximum, after which the logarithm of fluidity decreased linearly with time. The slope of the linear portion is related to absolute temperature by equation $s = A \exp(-B/T)$.

Here A and B are proportional to a frequency factor, K_o, and activation energy, E, the latter having high values indicating a chemical reaction. The theory developed applies to occurrence of two consecutive chemical reactions of first order,—initial softening of coal to form a fluid; and fall in fluidity due to fluid decomposing into solid (semi-coke). Though oversimplified, the theory accounts for behavior of coal in the plastic zone. O. P. Brysch

Coal Rank

Roberts, J. TRANSITION STAGES IN THE FORMATION OF COALS—1. *Coke and Gas* (British), 18, 25-28 (1956) January.

The process of conversion of vegetable matter to solid fuels of various rank by natural agencies is discussed. Systematic geological mapping around coal fields in Scotland has shown that the transition from relatively immature stage to the anthracitic stage is due to the variation in distance from the heat source, an igneous intrusive body. K. C. Channabasappa

Roberts, J. TRANSITION STAGES IN THE FORMATION OF COALS—2. *Coke and Gas* (British), 18, 68-72 (1956) February.

The variation in coal rank is mainly brought about by the differences in temperature and pressure to which the original immature coal was subjected. The process responsible for such a variation is termed thermal-metamorphism and the source of heat is magmatic. Detailed description of South Wales Coalfield together with the geology of the surrounding area is given to illustrate the effect of thermal-metamorphism. K. C. Channabasappa

Coal Sulfur

Brooks, J. D. ORGANIC SULPHUR IN COAL. *J. Inst. Fuel* (British), 29, 82-85 (1956) February.

A critical survey of published information on the origin and method of estimation of organic sulfur in coal and its effect on coking properties is presented. Larger amounts of organic sulfur lead to reduce air-dry moisture content and inpart a lower softening temperature by reducing the inter-molecular hydrogen bonding in coal, thereby producing a coke comparable to that from a normal coal of higher carbon and lower volatile content.

K. C. Channabasappa

Coal Thermal Analysis

Clegg, K. E. SOME EXPERIMENTAL FACTORS THAT MODIFY DIFFERENTIAL THERMOGRAMS OF BITUMINOUS COAL. State Geological Survey, Urbana, Illinois Rept. Invest. 190 (1955).

Investigation of bituminous coal by an adaptation of differential thermal analysis in which the sample is covered and heated in the absence of free air revealed that the resulting thermogram was strongly influenced by several experimental factors such as design of the specimen holder, control over oxidation, diluents mixed with coal, rate of heating and particle size. Thermograms obtained on the same coal employing different types of D.T.A. equipments also showed variations. Although D.T.A. serves as a useful tool in distinguishing different ranks of coal in broad terms, its use as a primary tool in qualitative coal study demands more refinement of technique employed in obtaining thermograms so that as many as possible of the minor variations in coals can be detected by the deflections they produce.

K. C. Channabasappa

Gasification

Cunningham, F. C., Berger, J. H., Rinkhoff, J. B. (assigned to Chemical Construction Corp.) CONTINUOUS PRODUCTION OF PURE CARBON MONOXIDE FROM COKE AND OXYGEN. U. S. 2,737,448 (1956) March 6.

Carbon monoxide for methanol synthesis is produced by reacting coke with a mixture of 1 part carbon dioxide and 1.75 parts of oxygen at a temperature of about 1975° F. The carbon dioxide controls the heat of reaction and is later removed from the carbon monoxide-carbon dioxide mixture by water scrubbing at 15 to 20 atmospheres pressure. Waste heat in the process is utilized for steam generation.

E. J. Pyrcioch

Peery, L. C., Hickman, G. A., and Hirsch, A. E. (assigned to E. I. du Pont de NeMours and Co.) COAL PARTIAL COMBUSTION WITH PURE OXYGEN. U. S. 2,738,263 (1956) March 13.

Synthesis gas is produced in a continuous process by reacting pulverized coal with oxygen or oxygen-enriched air and steam in a refractory-lined generator operating at atmospheric

pressure and at a temperature in the range 2550°-3090° F. The reactants are introduced to the top of the reactor and product gases are withdrawn at the bottom. Ash is removed as liquid slag at the bottom of the reactor and deposited in a water-quench tank.

E. J. Pyrcioch

Sze, M. C. and Campagnolo, J. F. A METHOD FOR DESIGNING THE STEAM RECOVERY SYSTEM IN CARBON MONOXIDE-STEAM "SHIFT" REACTION UNITS. *Chem. Eng. Progress*, 52, M121-26 (1956) March.

A theory is developed for designing efficient steam recovery systems or improving the operation of existing equipment. High and low pressure sample calculations are given.

W. G. Bair

Gas Plant Power

Clark, L. J. STEAM AND POWER IN THE GAS AND COKING INDUSTRIES. *J. Inst. Fuel* (British) 29, 106-28 (1956) March.

Trends in the steam and power demands of British gas works are described, with emphasis on experience of the North Thames Gas Board. Special treatment is given to steam load, waste-heat recovery, direct-fired boiler plant, electricity, works modernization, oil gas processes, chemical works, prime movers, gas pumping power, and gas turbines. The gas industry produces 75.7 therms of gas and coke per 100 therms of coal consumed, as compared with 23.4 therms of electricity per 100 therms of coal used as boiler fuel. Gas works boiler fuel averages 7 per cent of coal carbonized and effective modernization would reduce this substantially, the saving for the entire British gas industry amounting to over 1 million tons per year.

O. P. Brysch

Oil Gas

FIRST SEMET-SOLVAY PLANT AT WORK. *National Gas Bull.* (Australia), 20, 8-10 (1956) February.

This is a brief description of the first Semet-Solvay high Btu oil gas plant outside North America, recently completed near Sydney, Australia. From a residual oil, the plant makes benzol, toluene, xylene, light and heavy tar, ethylene and propylene for petrochemical production. Some gas is supplied to the Sydney area.

E. B. Shultz

Refinery Gas Storage

Duewel, G. DER UNTERTAGESPEICHER DER HAMBURGER GASWERKE G. M. B. H. (UNDERGROUND STORAGE FOR HAMBURG GASWERKE G. M. B. H. *Gas- und Wasserfach*, (German), 97, 169-75 (1956) March 1.

Underground storage of petroleum refinery gases is planned as a solution to the great increase in gas demand, the peak loads of which (35 million CF in June, 56 million in December) could not be satisfied by the existing coke-oven gas works in the near future. Esso A.-G. can supply 2800 million CF annually which will be stored underground in a salt-dome structure to the east of Hamburg in the old Reitbrook oil area. This is a 45 to 60-foot thick salt-water sand called the Neuengammer, which is sealed by the dense Septarien clay at a depth of 850 to 1950 feet. Such a storage dome, besides supplying Hamburg proper, would permit connections with the Ruhr pipelines, and expansion of service to Luebeck and Kiel. O. P. Brysch

Reformed Gas

Benz, G. R. and Bearer, L. C. (assigned to Phillips Petroleum Co.) MANUFACTURE OF FUEL GAS. U. S. 2,738,262 (1956) March 13.

A pebble heater with reactor and pebble return is used to crack propane-steam mixtures to produce water gas. The water gas is then automatically mixed with flue gas or propane to produce the required heating value and specific gravity for utility gas send-out. W. G. Bair

Reformer-Reducer

Galluser, H. (assigned to Ateliers des Charmilles S. A.) METHOD AND APPARATUS FOR REDUCING IRON ORES BY MEANS OF METHANE GAS. U. S. 2,739,055 (1956) March 20.

In an externally heated shaft furnace in which iron oxide is passed downward, methane is introduced into an intermediate zone held at 800° to 1000° C., where it reacts with water vapor and CO_2 to form hydrogen and carbon monoxide. The gases rise through the ore and are purified by removal of water and CO_2, leaving the H_2 and CO which are circulated to the base of the shaft, where they rise to produce the primary reduction. O. P. Brysch

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Absorption

Ellis, S. R. GAS ABSORPTION CALCULATIONS. *Petroleum Refiner*, 35, 127-31 (1956) February.

The development of the "difference point construction" method of graphical solution for multicomponent absorption problems is outlined. The method provides for varying liquid-to-gas ratios throughout the column, and is illustrated by a simple ammonia absorption calculation. Examples are also presented for multicomponent hydrocarbon absorption, and stripping. B. E. Eakin

Compression Equipment

Catt, C. D. and Hoffman, J. R. A COMPRESSOR STATION EMERGENCY SHUTDOWN AND VENTING SYSTEM. *Gas*, 32, 137-41 (1956) April.

The emergency shutdown and venting system developed by El Paso Natural is described. A description of the equipment used is given with a brief discussion of the reasoning behind the system selection. R. F. Bukacek

Hunziker, L. A. COMPRESSOR STATION FOUNDATION PREVENTS TRANSMISSION OF VIBRATION. *Gas* 32, 80-82 (1956) April.

Description of the design of compressor foundation in which provision was made for future spring mounting of compressors should vibration prove a major problem. R. F. Bukacek

Condensate Removal

Campbell, J. M. CENTRIFUGAL MIST EXTRACTION IN FIELD PROCESSING. *Oil Gas J.*, 54, 101-02 (1956) March 26.

Part 12 of a series on elements of field processing, this article gives information on the characteristics of cyclone separators. (See *Gas Abs.* 12, 97 (1956). R. F. Bukacek

Deming, P. H., and Sagenkahn, M. L. (assigned to Shell Development Co.) FRACTIONATION PROCESS. U. S. 2,722,113 (1955) November 1.
This invention describes an improved process for the separation of close-boiling hydrocarbon mixtures by fractional distillation. High separation efficiencies and reduced operating energy requirements are claimed. B. E. Eakin

Glasgow, C. O. (assigned to National Tank Co.) LOW TEMPERATURE GAS SEPARATOR. U. S. 2,739,460 (1956) March 27.
This invention combines in one structure the two known steps of high-pressure water knock-out and low temperature condensate separation. The preliminary high-pressure vessel properly baffled and drained is positioned within the low temperature separating vessel in such manner as to be immersed in the separated condensate, so that it gives up its heat to melt any hydrates formed in the expansion-cooled larger vessel. O. P. Brysch

Haverfield, F. B. (assigned to Continental Oil Co.) SEPARATING CO_2-PETROLEUM MIXTURES. U. S. 2,729,291 (1956) January 3.
A process is described for the recovery of the heavier hydrocarbons as liquid from a vapor phase containing large concentrations of CO_2. Recovery is accomplished by a shift in pressure and temperature conditions to place the vapor mixture substantially within the two-phase envelope; followed by separation of the resulting liquid and gas. B. E. Eakin

Karwat, E. (assigned to Gesellschaft f. Linde's Eismaschinen A.-G.) METHOD FOR THE PURIFICATION AND SEPARATION OF GAS MIXTURES. U. S. 2,727,587 (1955) December 20.
The improved method of removing a selected component from a gas mixture by absorption in a liquid is described. This process, where applicable significantly reduces the heat requirement for regeneration of the liquid sorbent. B. E. Eakin

Miller, E. B. (assigned to Jefferson Lake Sulphur Co.) CYCLIC ADSORPTION PROCESS. U. S. 2,739,669 (1956) March 27.
This invention relates to gas dehydrating and has particular reference to a novel continuous method of removing moisture and condensable hydrocarbons from wet natural gas and recovering the condensable hydrocarbons.
R. F. Bukacek

Miller, E. B. (assigned to Jefferson Lake Sulphur Co.) CYCLIC ADSORPTION PROCESS. U. S. 2,739,670 (1956) March 27.

Moisture and condensable hydrocarbons are recovered continuously from wet, high-pressure natural gas, by passing the gas through beds of adsorbent in one or more stages, then regenerating the adsorbent by a separate flow cycle of reactivating gas. Novelty is in mounting the beds as vertical compartments of an annular drum rotable between two plates forming fixed inlet and outlet manifolds properly registering with the compartments within a pressure vessel to permit injection and removal of natural gas and of reactivating gas from selected compartments at the same time. Thus absorbent compartments after saturation can be rotated (between the gasket-sealed manifolds) to connect them to a flow of activating gas (heated) from which the water and hydrocarbons are condensed in a separate gas circuit, and then further rotated to connect to a purging stream, after which the absorbent beds are ready to revolve into the absorbing position.

O. P. Brysch

Weil, A. H. GASOLINE PLANTS: HOW THEY OPERATE AND THEIR IMPORTANCE TO DISTRIBUTION COMPANIES. *Gas*, 32, 121-22, 124, 127 (1956) February.

The recovery of heavier hydrocarbon and removal of moisture from natural gas prior to transmission are two of the most fundamental operations in natural gas processing. These operations are described based on United Gas Pipe Line Company's plants and procedures.

B. E. Eakin

Dehydration

Drew, R. D. (assigned to Socony Mobil Oil Co., Inc.) CONTINUOUS GAS DEHUMIDIFICATION. U. S. 2,738,857 (1956) March 20.

This invention relates to a method for continuous removal of water from a gas stream by means of a granular solid desiccant. Specifically, a method of operating such a process is described in which the desiccant is regenerated by a sidestream, the regeneration gas being returned to the drying zone without the need for recompressing the wet gas. R. F. Bukacek

Drew, R. D. (assigned to Socony Mobil Oil Co., Inc.) CONTINUOUS GAS DEHUMIDIFICATION PROCESS. U. S. 2,738,858 (1956) March 20.

This invention relates to a method for removing moisture from a gaseous stream continuously by means for a granular solid desiccant. It deals with the operation of such a process so as to avoid the necessity of providing for external means of cooling the desiccant before it is supplied to the gas drying zone, or while in the gas drying zone. R. F. Bukacek

Fritz, R. J. and Etherington, L. D. (assigned to Esso Research and Engineering Co.) METHOD FOR ADSORBING, DESORBING, AND DEHYDRATING ADSORBENT IN FLUID ADSORPTION SYSTEM. U. S. 2,723,000 (1955) November 8.

This invention describes a continuous adsorption process for the separation of gaseous components by means of a finely-divided fluidized solid adsorbent. A reduction in the adsorbent heat and heat exchange requirements is claimed.

B. E. Eakin

Glaser, M. B. and Thodos, G. RECOVERY OF ETHYLENE GLYCOL FROM SPENT ANTIFREEZE SOLUTIONS. *Chem. Eng. Progress*, 52, 94-96 (1956) March.

A vacuum distillation technique has been devised for the recovery of low acidity ethylene glycol from spent antifreeze solutions. Neutralization of the feed material is obtained by use of solid sodium hydroxide, and unless the feed is excessively neutralized, the distillate product will be as acidic and corrosive as the feed.

B. E. Eakin

Kohl, A. L. and Riesenfeld, F. C. GAS CONDITIONING TODAY. PART II: DEHYDRATION. *Petroleum Refiner*, 35, 133-34 (1956) February.

Recent developments include the introduction of new, high capacity solid adsorbants and the use of more concentrated glycols, especially TEG, in liquid desiccants. The use of mixed liquid systems is also discussed.

B. E. Eakin

Drilling

McGhee, E. CENTRIFUGE CUTS MUD

COSTS. *Oil Gas J.*, 54, 106-07 (1956) February 6.

The use of a decanting-type centrifuge on lightweight drilling mud on 4 wells drilled in Louisiana has resulted in considerably reduced expenses for mud control. Tables are presented illustrating the savings obtained.

B. E. Eakin

McGhee, E. GIVE CREDIT TO NEW COMPLETION METHODS. *Oil Gas J.*, 54, 118, 122, 125 (1956) February 13.

Recently completed wells in the Mesa Verde formation in the San Juan Basin have open-hole potentials approximately double that of the older wells. The new completion techniques which are credited with this increased capacity include high volume injection and the use of water instead of oil as the carrier fluid.

B. E. Eakin

Rhodes, A. F., and Wilhoit, J. C., Jr. OIL AND GAS-WELL CASING SUSPENSION ASSEMBLIES. *Amer. Soc. Mech. Eng. Trans.*, 78, 225-32 (1956) February.

The mathematical equations expressing the behavior of well-casing and suspension assemblies are presented. The design applications of the theory and experimental data are discussed and an optimum casing-suspension design described. B. E. Eakin

Exploration

Bond, D. C. (assigned to The Pure Oil Co.) EXPLORATION FOR OIL BY SOIL ANALYSIS. U. S. 2,725,281 (1956) November 29.

This invention describes a geochemical prospecting method based on soil analysis of samples from a selected pattern, to determine their hydrocarbon content. An instrument for analysis of the results is also described. B. E. Eakin

Fletcher, H. B. WESTERN AUSTRALIA SCENE OF INTENSIVE OIL SEARCH. *Drilling*, 17, 94-95 (1956) March.

Although about 100,000 feet of hole has been drilled at great expense, only 2 oil wells have been found in this area. Exploration is increasing, and there is confidence that oil will be found in commercial quantities. B. E. Eakin

Flude, J. W. ROLE OF THE GEOPHYSICIST IN LOCATING THE WORLD'S NATURAL TREASURES. *World Petroleum*, 27, 94-5 (1956) March.

A short presentation of the part played by the geophysicist in the locating of petroleum and natural gas. The history of geophysics as applied to the search for oil is outlined.

B. E. Eakin

Woodward, H. P. NEW LOOK IS NEEDED IN APPALACHIAN BASIN. *World Oil*, 142, 96, 99-100 (1956) March.

Oil and gas resources in this region are not exhausted, as indicated by recently discovered reserves. This article outlines a program for up-dating the geological information for the area. B. E. Eakin

NEW TOOLS FOR THE GEOPHYSICIST. *World Petroleum*, 27, 99-102, 105-11 (1956) March.

This article describes recent advances in tools for geophysical studies. Many of the recent improvements are pictured, and discussed in detail. B. E. Eakin

Gas Mixing

Mather, N. G. RECEIVING AND BLENDING OIL GAS—PART II. *National Gas Bull.* (Australia), 20, 20-22 (1956) February.

This is part of a series on gas mixing. Objectives were to send out a 555 Btu/SCF gas and to introduce a controlled quantity of low-oxygen flue gas to adjust combustion characteristics. The necessary instrumentation for automatic control is described. E. B. Shultz

Warner, C. W. FUNDAMENTALS OF GAS MIXING—PART II: A LOOK AT THE EQUIPMENT. *Gas*, 32, 75-80 (1956) March.

The operation of a volumetric proportioning system is described. Three methods of calorimetric control are given and evaluated with respect to applicability. S. A. Weil

Warner, C. W. TYPICAL CONTROL SYSTEMS, PROPORTIONAL PEAK SHAVING, AND STANDBY CONTROL. *Gas*, 32, 83-91 (1956) April.

The last of a 3-part series on fundamentals of gas mixing, this article describes three types

of control; simplified control with motor operated valve, control with volumetric proportioning and control using differential pressure regulators for proportioning. The article concludes with a discussion of proportional peak shaving and standby control. R. F. Bukacek

LP-Gas Uses

Abell, C. AGRICULTURAL FLAMING: HI-YO, SILVER! PROPANE RIDES THE RANGE; PROPANE CUTS COST OF WEED CONTROL ON RAILWAY RIGHTS-OF-WAY. *Butane-Propane-News*, 18, 31-54 (1956) March.

These articles provide a very complete description of the utility of LP-gas for weed destruction, crop improvement and even treating cactus to provide livestock food. R. T. Ellington

Brendle, R. W. SELLING PROPANE FOR FLAME CUTTING FUEL IS EASY—HERE'S HOW. *Butane-Propane News*, 18, 78-84 (1956) March.

The advantages of using propane for cutting are numerous and quite significant: safety, reduction in cylinder handling, savings in oxygen and cleaner cuts are all important items. R. T. Ellington

Odorization

ODORIZER VENTING METHOD IMPROVED. *Amer. Gas J.*, 183, 15 (1956) March.

Purification of odorizer vent gas by bubbling through sodium hypochloride solution was found to be preferable to use of activated charcoal. D. M. Mason

Offshore Operations

McGhee, E. PERMANENT-TYPE COMPLETION PAYS OFF OFFSHORE. *Oil Gas J.*, 54, 102-03 (1956) March 12.

Humble Oil Co. recently reworked an off-shore well utilizing wire-line permanent-type completion equipment. The well was successfully cemented and recompleted in a higher zone for an estimated 16% of the cost of doing the job with a conventional rig. B. E. Eakin

Permeability Factors

Herzog, G. and Ten Brink, K. C. (assigned to The Texas Co.) RELATIVE PERMEABILITY MEASUREMENTS. U. S. 2,737,804 (1956) March 13.

This invention relates to an improved apparatus for the determination of effective or relative permeability of porous media to non-miscible fluids flowing simultaneously. In this method the core is first saturated to a given percent of pore space with a fluid which can be made immobile in-situ, and the permeability to a second fluid then measured. B. E. Eakin

Howell, B. F., Jr. and Cervik, J. COMPARISON OF X-RAY DIFFRACTION AND K-FACTOR STUDIES OF THE CLAY CONTENT OF ARTIFICIAL CORES. *Producers Monthly*, 20, 36-40, 42-44 (1956) February.

Experimental results obtained on cores composed of ground Oriskany sandstone and Georgia kaolin as to the correlation between X-ray and K-factor studies are presented. It was determined that the percentage of quartz and kaolinite in a sample could be determined by X-ray techniques. B. E. Eakin

Pipeline Efficiency

Rifenburg, A. W. STRIPPER PLANT BOOSTS PIPELINE EFFICIENCY. *Oil Gas J.*, 54, 97-8, 100 (1956) March 5.

A report of experience on Mississippi River Fuels Corp. pipeline system where it was found that removing a part of the heavier hydrocarbons from the gas before its entry into the pipeline gave markedly improved pipeline performance. R. F. Bukacek

Turbodrill

TURBODRILL DEAL SET. *Oil Gas J.*, 54, 87 (1956) March 12.

Dresser Industries has purchased the rights to the much discussed Russian turbodrill which is advertised as a great step forward in increasing drilling rates and reducing drilling costs. It is supposedly in extensive use in Russia. B. E. Eakin

The following article, the abstract for which appears on the page indicated, is also called to your attention:

Rubin, F. L. PROPERTIES OF HYDROGEN MIXTURES. p. 115.

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Air Force Pipelines

AF PIPELINE PLAN IN DOUBT. *Petroleum Week*, 2, 33, 35 (1956) March 16.

The Air Force wants lines to be built to service some 35 additional air bases, preferably to be constructed and operated by common-carrier pipeline companies. The snag is apparently the fact that the AF will give no guarantee the lines will be used long enough to justify the cost of building then. B. E. Eakin

Conversion Catalysts

Voorhees, V. RECENT PROGRESS IN PETROLEUM CONVERSION CATALYSTS. *Petroleum Eng.*, 28, C11-14 (1956) March.

This review considers fifty-three references, mostly from the patent literature on conversion catalysts (cracking reforming, hydroforming, polymerization and aromatization). Sections on catalyst preparation techniques, fundamental studies and poisons are also included.
E. B. Shultz

Warrick, H. R. (assigned to The Texas Co.) CATALYTIC CONVERSION OF HYDROCARBONS WITH PRESSURE REGULATION IN THE CONVERSION AND REGENERATION ZONES. U. S. 2,738,310 (1956) March 13.

A balanced pressure fluid catalytic reactor-regenerator system is described. The system is supposed to eliminate reversal of solid streams.
W. G. Bair

Desulfurization

Sutherland, D. A. and Wheatley, F. W. DESULFURIZING BY HYDROFINING "DOWN UNDER". *Petroleum Eng.*, 28, C37, 40, 42, 44 (1956) March.

The diesel oil desulfurizing unit installed at the Kwinana refinery of Australasian Petroleum Refinery Ltd. is described. D. M. Mason

Fuel Oil Demands

Foster, A. L. RESIDUAL FUEL OIL—WHERE IS IT GOING? *Petroleum Eng.*, 28, C6-10 (1956) March.

The various present demands for residual oils are discussed and future demands are predicted. Needs for more residuals as cat-cracker charge and for distillate fuel oils, will pinch residual availability more and more. New demands for residuals as fuel for turbine-electric power plants in locomotives and ships are expected to develop and slow the decline in heavy fuel consumption, but will not stop or reverse the trend. Indications are that residual fuels will be crowded out of uses where the advantage has been purely economical. E. B. Shultz

Oil Transportation

Dougary, J. M. MODERN CRUDE OIL LOADING TECHNIQUES AT MINA-AL-AHMADI, KUWAIT. *J. Inst. Petroleum* (British) 42, 1-22 (1956) January.

The paper describes the build up of crude oil loading capacity at the Mina-al-Ahmadi loading terminal of Kuwait Oil Co. Ltd. from the time of the initial shipment in June 1946 until March 1955 when exports had reached in excess of 1.0 million b.d. The facilities which have been provided and the methods adopted to enable the high export rates to be met are described and discussed. Author's Abstract

Production Peak?

IS OIL NEARING A PRODUCTION CRISIS? *Petroleum Week*, 2, 9-11 (1956) March 16.

A prominent Texas geologist predicts the U. S. oil production may reach its peak by about 1965 and then decrease by 5 to 10% a year thereafter. This coincides with recent reports by other sources. B. E. Eakin

Refining Capacity, 1965

TO MEET THESE DEMANDS IN 1965, U. S. REFINERS WILL NEED 50% MORE CAPACITY. *Petroleum Processing*, 11, 63-5 (1956) March.

A ten-year forecast of petroleum consumption and required investment in production, refining and marketing facilities is presented, based on a survey by the Petroleum Department of the Chase Manhattan Bank. The survey includes both domestic and Free Foreign World demands. Domestic refining capacity is expected to increase from the current 8.4 million b/d to about 12.6 million b/d by 1965. This is estimated to require additional capital investment

of more than 11 billion dollars. Domestic petroleum demands have been broken down into individual product requirements which show an increased consumption rate trend for jet fuel, and LPG, and a decreased consumption rate trend for motor fuel, distillate fuel and residuals over the next ten years.

J. M. Reid

Shale Oil Production

Martin, H. Z., and Lewis, W. K., Jr. (assigned to Esso Research and Engineering Co.) SHALE DISTILLATION. U. S. 2,738,315 (1956) March 13.

This shale distillation scheme claims improvements in preheating of the shale feed. A major portion of the feed is ground to 1-3 inches and passes downward in a moving bed countercurrent to flow of the hot gaseous products of distillation. The remainder of the shale feed is preheated with a pebble heater. Hot pebbles previously heated by contact with spent shale are contacted with the shale feed which in this case is ground to fluidizable size. Preheating in these two ways is necessary since the gaseous products do not have enough heat to preheat the entire charge to 500-900° F. The shale distillation itself would be carried out in any conventional fluidized system. E. B. Shultz

Smith, J. W. SPECIFIC GRAVITY-OIL YIELD RELATIONSHIPS OF TWO COLORADO OIL-SHALE CORES. *Ind. Eng. Chem.*, 48, 441-54 Part I (1956) March.

In estimation of oil-shale reserves, oil yields determined analytically on a weight basis must be converted to a volume basis by use of the shale specific gravity. To permit doing this without determining specific gravity, empirical relations between oil yield per ton and specific gravity were developed from 200 determinations from two locations in the Green River oil shale formation. Results indicate that as oil yield increases from zero to 80 gal per ton, specific gravity decreases from about 2.7 to 1.6 by a parabolic relationship which allows prediction of values within five percent.

E. B. Shultz

7. ANALYTICAL METHODS AND TESTS

Dissolved Oxygen

Levine, H. S., Warren, W. V., Tsivoglou, E. C., and Walker, W. W. CONTINUOUS MEASUREMENT OF DISSOLVED OXYGEN IN WATER. *Anal. Chem.*, 28, 343-49 (1956) March.

A method for the continuous measurement of dissolved oxygen in water has been developed, based on establishing a Henry's law equilibrium between a flowing water sample and the oxygen content of a gas at constant pressure and volume. The results are not influenced by temperature, salt content, pollution, aeration constant, barometric pressure, or the dissolved nitrogen content of water. Experimental confirmation of the method for dissolved oxygen in water is presented. The design and performance characteristics of the major components of a practical instrument are given.

Authors' Abstract

Studebaker, M. L., Huffman, E. W., Wolfe, A. C., and Nabors, L. G. OXYGEN-CONTAINING GROUPS ON THE SURFACE OF CARBON BLACK. *Ind. Eng. Chem.*, 48, 162-66 (1956) January.

A chemical method of determining oxygen containing groups on carbon black surfaces is described. D. V. Kniebes

Gilsonite Hydrocarbons

Sugihara, J. M. and McCullough, T. F. ANALYSIS OF HYDROCARBON FRACTION OF GILSONITE. *Anal. Chem.*, 28, 370-74 (1956) March.

Utah gilsonite was subjected to chromatographic separation, and 4 to 8% of hydrocarbons were found. Of these, 30 to 40% were aromatic and 60 to 70% were naphthenic. No olefins were found, and ultraviolet spectra of the aromatic portions indicated the presence of alkylnaphthalenes. Ring analysis on the nonaromatic portions gave strong evidence of saturated monocyclic compounds. A fraction obtained from pyrolysis of gilsonite was subjected to urea adduction, and found to contain more straight-chain hydrocarbons, due to cleavage of complex cyclic compounds. The nonhydrocarbon portion of gilsonite contained 2.5% nitrogen, 0.5% sulfur and virtually no oxygen, but was not further analyzed. E. B. Shultz

Ion Exchange

Morries, P. and Stuckey, R. E. LABORATORY APPLICATIONS OF ION EXCHANGE RESINS. PART I. *Lab. Practice*, 5, 92-97 (1956) March.

Fundamental properties and techniques of use and preparation, and several applications of ion exchange resins are reviewed briefly. Applications include determination of total salt concentration (including insoluble salts such as barium sulfate) by removal either of cation or anion. Methods of separation of similar ions by use of complexing agents, selective conversion of cations to anions, and by chromatographic technique based on differences in exchange potentials are discussed briefly.

D. M. Mason

Spectroscopy Review

Meggers, W. F. EMISSION SPECTROSCOPY. Anal Chem., 28, 616-21 Part II (1956) April.

A brief summary, with 99 references, covering the advances in emission spectroscopy for the period 1954-1955. R. R. Amrine

Ultrasonics for Oil

Geelen, H., Waterman, H. I. and Westerdijk, J. B. APPLICAZIONE DELLA VELOCITA DEGLI ULTRASUONI ALLA ANALISI STRUCTURALE DEGLI OLI MINERALI (APPLICATION OF ULTRASONIC VELOCITIES TO THE STRUCTURAL ANALYSIS OF MINERAL OILS). *Rivista dei Combustibili* (Italian), 10, 3-26 (1956) January.

Velocity of sound in a large number of mineral oil fractions has been correlated with structural constants. Average number of aromatic and naphthenic rings can be calculated from specific sound velocity, specific refraction and molecular weight. E. B. Shultz

8. GENERAL AND PHYSICAL CHEMISTRY

Compressibility

Akers, W. W. and Burns, J. D. COMPRESSIBILITY FACTORS OF MIXTURES. *Petroleum Refiner*, 35, 154 (1956) March.

A compressibility chart for mixtures of hydrogen and hydrocarbons is presented. The chart covers the range of reduced temperatures of from 1.8 to 15 and reduced pressures up to 5. B. E. Eakin

Aronofsky, J. S. and Porter, J. D. UNSTEADY RADIAL FLOW OF GAS THROUGH POROUS MEDIA—VARIABLE VISCOSITY AND COMPRESSIBILITY. *J. Appl. Mech.*, 23, 128-32 (1956) March.

Calculations of the pressure-time history and flow rates for radial unsteady flow of gases through porous media were obtained by use of the M.I.T. "Whirlwind" digital computer, and are presented in graphical form. Properties studied included viscosity and compressibility, and the results demonstrate that variations in these properties can exert a substantial effect on transient gas-flow systems. B. E. Eakin

Hoot, W. F. NEED HYDROGEN COMPRESSIBILITY FAST? *Petroleum Refiner*, 35, 150 (1956) March.

A compressibility chart for hydrogen is presented for pressures up to 1600 psia and temperatures from —350° to 600° F. B. E. Eakin

Hydrogen Behavior

Williams, A. L., Oberright, E. A. and Brooks, J. W. THE ABSTRACTION OF HYDROGEN ATOMS FROM LIQUID HYDROCARBONS BY t-BUTOXY RADICALS. *J. Amer. Chem. Soc.*, 78, 1190-93 (1956) March 20.

t-Butoxy radicals were used to measure the rate of removal of hydrogen atoms from liquid hydrocarbons. Reactivities of various types of hydrogen atoms are compared. E. B. Shultz

Rubin, F. L. FINDING THE PROPERTIES OF HYDROGEN MIXTURES. *Petroleum Refiner*, 35, 141-149 (1956) March.

Data are presented on the viscosity, thermal conductivity, specific heat, and density behavior of hydrogen, and methods of predicting viscosity behavior of mixtures of hydrogen and other gases. Examples are given of the calculation of viscosity and thermal conductivity of mixtures. B. E. Eakin

H_2S Equilibria

Hoffman, D. S. and Weber, J. H. NEED MORE DATA ON H_2S? *Petroleum Refiner*, 35, 213-15 (1956) March.

Vaporization equilibrium constants for H_2S are presented for the temperature range from —76.4° to 212.7° F. and for pressures up to 1000 psia. The data of Reamer, Sage and Lacey were used throughout. B. E. Eakin

Low Temperature Research

Wexler, A. LOW TEMPERATURE RESEARCH. *Westinghouse Eng.*, 16, 34-38 (1956) March.

Certain of the phenomena observed at low temperatures, in the range from —300 to —450° F., are described. The research that is being conducted in this field is also described, and various possible commercial applications for these extremely low temperatures are discussed.

B. E. Eakin

Radioisotopes

Rothchild, S. and Shapiro, E. ISOTOPES IN RESEARCH AND DEVELOPMENT. *Research and Eng.*, 11, 18-24 (1956) January.

The use of radioisotopes for research and development purposes is described and several examples are given. D. V. Kniebes

Thermal Conductivity

Cecil, O. B. and Munch, R. H. THERMAL CONDUCTIVITY OF SOME ORGANIC LIQUIDS. *Ind. Eng. Chem.*, 48, 437-40 (1956) Part I, March.

Use of the hot-wire method for a number of conductivity measurements is described. Though the authors feel that reproducing results with the cell tipped at 30° is sufficient to show absence of convection, the inherent risk in using this method remains. R. T. Ellington

9. ORGANIC CHEMISTRY

Carboxylic Acids

Koch, H. SINTESI DI ACIDI CARBOSSILICI DA OLEFINE, OSSIDO DI CARBONIO ED ACQUA. (SYNTHESIS OF CARBOXYLIC ACIDS FROM OLEFINES, CARBON MONOXIDE AND WATER.) *Rivista dei Combustibili* (Italian), 10, 77-100 (1956) February.

The Max Planck Institut fuer Kohlenforschung, at Muelheim-Ruhr, has developed a new procedure for the synthesis of carboxyl acids by the addition of carbon monoxide and water to olefines. This method differs from those known heretofore by the particularly mild reaction conditions adopted, namely the low temperatures, preferably between 0 and 30° C., and relatively low pressure, generally from 20 to 100 atm. The procedure, which takes place in the presence of acid catalysts, is characterised by the fact that at the beginning the reaction with carbon monoxide occurs in the absence of water and the necessary quantity thereof is added only subsequently. The catalysts used are principally concentrated sulfuric acid or blends of acids containing boron fluoride in complex bonds. The carboxyl acids obtained by the new method of synthesis, mostly with very good yields, all contain a chain of branched carbon atoms with single or double branching to the carbon atom next to the carboxyl group. From the experimental findings currently available it can be deduced that the products of the new synthesis of carboxyl acids offer interesting fields of use. Author's Abstract

Gas Chemicals

Reidel, J. C. AMMONIA MANUFACTURE BY GAS REFORMING. *Oil Gas J.*, 54, 106-13 (1956) March 26.

This is a description of the ammonia from natural gas facility operated by Phillips Chemical near Houston. Design capacity is 450 tons per day of anhydrous ammonia most of which is converted to ammonium sulfate. Details of the gas reforming and ammonia synthesis processes are given. E. B. Shultz

TWO NEW GIANTS FOR TEXAS. *Oil Gas J.*, 54, 72 (1956) March 5.

Construction of two large petrochemical plants will begin in Texas this spring. Firestone will build a 40,000 ton butadiene plant near Orange on the Gulf coast. A four-company combine (El Paso Natural Gas, United Carbon, Odessa Natural Gas, General Tire and Rubber) will build a $30 million butadiene-synthetic rubber plant near Odessa in West Texas. Byproducts would include isobutane for a projected alkylation plant, and considerable hydrogen, enough to make 175 tons per day of anhydrous ammonia. E. B. Shultz

Phenol Process

Mosnier, M. M. (assigned to Societe des Usines Chimiques Rhone Poulenc) PRODUCTION OF PHENOLS AND CARBONYL COMPOUNDS. U. S. 2,737,527 (1956) March 6.

A French process for phenol aldehyde and ketone production by decomposition of cumene hydroperoxides is described. Perchloric acid is the novel catalyst claimed by the authors.

E. B. Shultz

10. CHEMICAL ENGINEERING

Bubble Cap Trays

Bolles, W. L. OPTIMUM BUBBLE-CAP TRAY DESIGN. PART II—DESIGN STANDARDS. *Petroleum Processing*, 11, 82-95 (1956) March.

The second of a series on design of bubble-cap trays, this article gives recommendations for a variety of factors in tray design; overflow weirs, cap design, skirt heights and cap fastening. Tray dynamics are discussed with suitable equations and correlations of tray performance, and tray design standards are offered.

R. F. Bukacek

CO_2 Separation

Bronson, S. C. (assigned to Air Reduction Co., Inc.) SEPARATION OF GAS BY SOLIDIFICATION. U. S. 2,738,658 (1956) March 20.

Waste gases, such as synthetic ammonia plant waste gas, containing large quantities of carbon dioxide mixed with other more volatile gas, is moved by a blower through a countercurrent heat exchanger and into a freezer tank containing a finned coil cooled by recycling liquid nitrogen or air. The CO_2 solidifies on the coil until sufficient deposit is built up, while other constituents gases are wasted through the inlet heat exchanger. Then valve switching closes the inlet and opens the freezer to a liquid CO_2 storage tank held at above 5.11 atm abs and above temperatures of —56.6° C., which conditions cause the solid CO_2 to liquefy and drain to the storage. Continuous operation is achieved by providing two freezer tanks and switch valves.

O. P. Brysch

Eichmann, T. (assigned to International Carbonic Eng. Co.) PROCESS AND APPARATUS FOR RECOVERING CARBON DIOXIDE FROM EXHAUST GASES. U. S. 2,742,102 (1956) April 17.

This invention claims methods and apparatus for recovering carbon dioxide from flue gases by use of a solution of potassium carbonate.

R. F. Bukacek

Cracking Units

Perkins, T. K. and Rase, H. F. A SIMPLIFIED METHOD FOR DESIGNING LIGHT HYDROCARBON CRACKING UNITS. *Chem. Eng. Progress*, 52, 105-110 (1956) March.

A new method is said to require only one quarter of the time usually spent with the stepwise trial-and-error method in general use. Heater is divided into two sections—preheat and reaction — and new design equations are integrated by use of series of working charts, included. Method adaptable to cases where heating varies rapidly.

Authors' Abstract

Fluid Flow

Hughes, R. R. and Oppenheim, A. K. FLUID DYNAMICS. *Ind. Eng. Chem.*, 48, 633-54, Part II (1956) March.

A survey of the literature on fluid dynamics appearing in 1954-55 is presented. Over 300 references cover the fields of turbulence, flow stability, boundary layers, jets, flames, ducted flow, and non-steady state flow.

S. A. Weil

Weintraub, M. FLOW OF FLUIDS. *Ind. Eng. Chem.*, 48, 532-39 Part II (1956) March.

Industrial and Engineering Chemistry's annual review of the past year's contribution to the technical literature of fluid flow.

R. F. Bukacek

Heat Transfer

Akers, W. W. and Sampson, O. A. SHORTEN HEAT TRANSFER PROBLEMS. *Petroleum Refiner*, 35, 152 (1956) March.

The heat transfer equation has been rearranged and the physical properties of a material affecting heat transfer collected into a separate term called the "physical property factor". This greatly facilitates calculations.

B. E. Eakin

Donohue, D. A. HEAT EXCHANGERS. *Petroleum Processing*, 11, 102-32 (1956) March.

A good, detailed presentation of exchanger types, design, and costs.

W. G. Bair

Granet, I. and Gould, R. M. SHORTCUTS FOR TRANSIENT HEAT FLOW. *Chem. Eng.*, 63, 183-86 (1956) February.

With this combination, you must know how far you can go. You can now recheck your thinking about unsteady state heat flow and analyze transient problems,—nuclear reactors, for example.

Authors' Abstract

McCarthy, L. J. RADIANT DESIGN OF HIGH TEMPERATURE HEATERS AND THE CHEMICO HEATER. *Chem. Eng. Progress*, 52, 97-104 (1956) March.

This study is primarily a first step in the development of a method of evaluating the performance of the radiant combustion sections of fuel-fired heaters and boilers. Such a method should be useful both as a means for designing new equipment and for comparing the operating performance of different furnace designs on an equitable basis. Author's Abstract

Mekler, L. A. MECHANICAL ENGINEERING. MECHANICAL DESIGN OF PROCESSED TUBULAR HEATERS. PART I. *Petroleum Eng.*, 28, C15-20 (1956) March.

Part 1 gives general cost information and comparison on several types of tubular heaters. Types and structural details are also discussed. W. G. Bair

Liquid Oxygen

Becker, R. and Hartman, W. (assigned to Gesellschaft fuer Linde's Eismachinen A-G.) APPARATUS FOR OBTAINING LIQUID OXYGEN. U. S. 2,737,784 (1956) March 13.

An apparatus is described for obtaining liquid oxygen. The method is supposed to reduce losses due to heat flow into the cold chamber. B. E. Eakin

Plant Safety

Smith, J. H. EXPLOSION, POISONS, AND THE CHEMICAL ENGINEER. *Chem. and Process Eng.* (British), 37, 93-95 (1956) March.
The American position on plant safety and design is compared to the British. The biggest difference is that most safety laws in Britain have been centralized in the Central Government while in the U.S.A. states still exercise control. W. G. Bair

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Computer Applications

Middleton, M., Jr. PRODUCT DESIGN BY DIGITAL COMPUTERS. *Westinghouse Eng.*, 16, 39-43 (1956) March.
In product design, digital computers can be utilized to effect savings in engineering time and manufacturing costs. Extensive studies can be made by use of the digital computer, of product performance under variation of one or more design parameters, in a reasonable length of time. Also, computers can be utilized to reduce the load of burdensome routine calculations, thus freeing the engineer for creative work. B. E. Eakin

SOHIO PREPARES TODAY TO USE TOMORROW'S ELECTRONIC BRAINPOWER. *Petroleum Week*, 2, 24-26 (1956) March 9.

Since 1952 Standard has been studying the application of electronic digital computers to oil prospecting, production, handling, and processing problems. They have installed several of the IBM Magnetic Drum 650 computers. In June, 1956 they will receive one of the first Model 705 giant electronic computers, and have created a special department to facilitate its use. B. E. Eakin

Gas Scrubber

Kinney, S. P. (assigned to S. P. Kinney Eng., Inc.) GAS WASHER. U. S. 2,738,178 (1956) March 13.

This patent describes a water-sprayed tower having tile beds for removing dust from blast furnace gas. The tiles are hexagonal in shape and have venturi throat openings for gas circulation and washing. E. J. Pyrcioch

Mechanical Seals

Elonka, S. MECHANICAL SEALS. *Power*, 100, 109-132 (1956) March.

The article covers basic design and installation of mechanical seals as well as materials of construction, and maintenance of operating seals. W. G. Bair

Radiant Energy

AN EXAMINATION OF THE MEASUREMENT OF RADIANT ENERGY. Gas Council (British) Res. Commun. GC28 (1955) November.

Three instruments for the measurement of radiant energy are described. Methods and accuracy of calibration are discussend and experimental measurements of the radiant energy of small electric and gas radiant heaters are presented. D. V. Kniebes

Moisture Recorder

CHECKING WATER VAPOR CONCENTRATIONS IN FLOWING GAS STREAMS. *Pipe Line News*, 28, 28, 30, 32 (1956) March.

A description of the continuous, automatic water content recorder developed by Mine Safety appliances Co. and Esso Research and Engineering Co. The operation of this machine is based on the heat of adsorption of water on a suitable dessicant. R. F. Bukacek

Oil Measurement

Falk, O. NEW METHODS FOR THE MEASUREMENT OF OIL QUANTITIES. *J. Inst. Petroleum* (British), 42, 27-32 (1956) January.

After study and investigation extending over many years, instruments first devised for use in the measurement of gases have been successfully adapted to the measurement of the levels of liquid surfaces and therefore to several aspects of oil measurement work. According to their particular applications, these new instruments take various forms, which with their applications are described substantially in the order in which they were developed. Results from these new instruments and methods compare favourably with those from conventional routine methods. Author's Abstract

Pressure Vessels

Schneider, R. W. HELP IN DESIGNING PRESSURE VESSELS. *Chem. Eng.*, 63, 171-73 (1956) February.

More and more, we are leaving the simple inexact formulas used in pressure vessel design. Take a look at this rapid graphical method for flat heads—and save with minimum safety factors. Author's Abstract

12. MATERIALS OF CONSTRUCTION

Coatings

Lewis, J. M. (assigned to Williams Brothers Co.) METHOD OF PROCESSING PIPES. U. S. 2,734,832 (1956) February 14.

This patent covers a method of applying coating material to the inside of pipelines by use of a spray head mounted on a tubular boom. In order to assure relatively uniform application of the coating material, suitable machinery is provided to rotate the pipe. G. G. Wilson

Corrosion

Backensto, E. B., Drew, R. D. and Stapleford, C. C. THREE WAYS TO FIGHT H_2S CORROSION. *Oil Gas J.*, 54, 104-06 (1956) March 5.

Corrosion tests conducted in laboratory, pilot plant, and commercial units for the processing of petroleum stocks at high temperatures and pressures are reported. These tests indicate that H_2S corrosion in such units can be reduced in three ways: 1) Reduction of H_2S content of the process streams; 2) use of chrome-nickel alloys; 3) use of aluminum coatings. (See also *Gas Abs*, 12, 79, April (1956). G. G. Wilson

Resen, L. SOUR-WATER STRIPPING UNIT. *Oil Gas J.*, 54, 138, 141, 143 (1956) March 12.

The process for removal of sulfides from certain water effluents at Shell's Houston refinery consists of injection of sulfuric acid followed by steam stripping. Improvements including use of acid injection tips made of Teflon, and use of epoxy-type paint as a corrosion-resistant coating in the stripper are described together with other details of the process and equipment. D. M. Mason

Moisture Movement

Babbitt, J. D. THE MOVEMENT OF MOISTURE THROUGH SOLIDS. *Amer. Soc. Test. Materials Bull.* 1956, 58-61, February.

There is probably no subject of wider applicability in ASTM work than that of moisture. Evidence of this may be found in the 1955 Index to Standards which contains 58 entries under the heading "Moisture Test." The presence of moisture influences corrosion of metals, it is a necessary processing ingredient for ceramics, masonry, concrete, etc., and in many structures it is important to keep moisture out (buildings) or to keep it in (tanks). Passage of moisture through the walls of a building causes paint to peel and, when it condenses and freezes, impairs insulation efficiency and does damage to the structure. Moisture influences the character and quality of soils, paper, textiles, wood, electrical insulation, leather and many other materials. Sometimes we want it present, sometimes absent. It is very desirable that it be present in cotton, but it plays hob in a mass spectrograph. In this paper, the author reviews the various physical concepts which

relate to the movement of moisture through solids, analyzing moisture movement in its six possible states—vapor, liquid, solid, chemical compound, adsorbed, and dissolved. Through better understanding of the mechanism by which moisture behaves in solids, ASTM committees can devise more meaningful tests involving moisture in engineering materials.

Editor's Abstract

Plastics

Wittenwyler, C. V. USING THE EPOXY RESINS. *Chem. Eng. Progress*, 52, F53-56 (1956) February.

A summary of the uses which have been found for epoxy resins in coatings, laminates, castings, and adhesives. The primary properties of these resins and a diagram showing the manner in which raw materials are combined to produce these resins are included. G. G. Wilson

Wohnsiedler, H. P. CURE OF THERMOSETTING RESINS. *Ind. Eng. Chem.*, 48, 71-114 (1956) January.

A symposium on the curing of thermosetting resins which includes the following papers: Borr, E. "Degree of Cure in Thermosetting Resins". The reasons for the success of the more important types of thermosetting resins and differences in the method of curing of these resins are explained. Methods of measuring cure are also presented. Cranker, K. R. and Breslau, A. J.: "Epoxy Casting Resins Modified with Polysulfide Liquid Polymer." The properties of compounds produced by coreacting epoxy resins with polysulfide liquid polymer are described. These compounds are very flexible and have excellent casting properties. The effect of rate and state of cure of these compounds on their properties are also examined.

G. G. Wilson

13. NEW BOOKS

(C. A. Simms, Librarian)

Chemical Compounds

Dreisbach, R. R., compiler, PHYSICAL PROPERTIES OF CHEMICAL COMPOUNDS. Washington, D. C.: American Chemical Society, 1955. (Advances in Chemistry Series, No. 15.)

Comprehensive data on 511 organic cyclic compounds in systematic tabular form.

Chemical Pilot Plants

Jordan, D. G. CHEMICAL PILOT PLANT PRACTICE. New York: Interscience Publishers, Inc., 1955.

The book covers the major phases of pilot plant practice which are equipment type and size, scale-up, process material handling, cost estimation and report writing. Any attempt to classify pilot plant operation will involve some arbitrary decisions. These decisions are noticeable but not distracting. W. G. Bair

Piping Design

Kellogg, M. W., Company. DESIGN OF PIPING SYSTEMS. 2nd ed. New York: John Wiley & Sons, 1956.

Written by the engineering staff of the M. W. Kellogg Co., this book covers the entire subject of structural design (stress analysis) of piping. A completely rewritten and expanded second edition, it covers evaluation of weight and wind stresses, in addition to calculation of expansion stresses and reactions in piping systems.

Power Reactors

Thompson, A. S. and Rodgers, O. E., THERMAL POWER FROM NUCLEAR REACTORS. New York: John Wiley & Sons, 1956.

Written from a mechanical engineer's viewpoint, this book stresses the design approach of problems of reactor development.

Safety

Guelich, J., CHEMICAL SAFETY SUPERVISION. New York: Reinhold Publishing Co., 1956.

Cartoon-type illustrations make this how-to-do-it handbook of safety a must for everyone who manufactures, handles or uses chemicals. There are chapters explaining tested, proven methods of teaching new men the use of chemicals, moving and storing chemicals and first aid.

The following article, the abstract for which appears on the indicated, is also called to your attention:

Shaw, B. V. AUTOMATIC PILOTS FOR COMMERCIAL GAS COOKING EQUIPMENT. p. 102

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Periodicals Abstracted for GAS ABSTRACTS

Air Conditioning, Heating and Ventilating
American Chemical Society. Journal
American Gas Association Monthly
American Gas Journal
American Petroleum Institute Quarterly
American Society for Testing Materials Bulletin
American Society of Mechanical Engineers. Transactions
Analytical Chemistry
Appliance Manufacturer
Applied Spectroscopy
Association for Computing Machinery, Journal
Australian Journal of Applied Science
Australian Journal of Chemistry

Bituminous Coal Research Reports
Brennstoff-Chemie
British Coal Utilization Research Association Monthly Bulletin and Quarterly Gazette
Butane-Propane News

California Oil World
Canadian Chemical Processing
Canadian Gas Journal
Canadian Journal of Chemistry
Canadian Journal of Physics
Canadian Journal of Technology
Chemical and Engineering News
Chemical and Process Engineering
Chemical Engineering
Chemical Engineering Costs Quarterly
Chemical Engineering Progress
Chemical Engineering Science
Chemical Processing
Chemical Reviews
Chemical Society (London) Journal
Chemical Week
Chemistry and Industry
Coal Heat
Coke and Gas
Combustion
Computers and Automation
Construction Methods and Equipment
Corrosion

Drilling

Engineers' Digest
Erdöl und Kohle

Faraday Society. Transactions
Fuel
Fuel Efficiency
Fueloil and Oil Heat

Gas
Gas Age
Gas and Oil Power
Gas Council (British) Publications
Gas Heat
Gas Journal
Gas Times
Gas und Wasserfach
Gas World

Heating, Piping and Air Conditioning

Independent Petroleum Association of America Monthly
Industrial and Engineering Chemistry
Industrial Finishing
Industrial Gas (American)
Industrial Gas (British)
Industrial Heating
Institute of Fuel (British). Journal
Institute of Gas Technology Publications
Institute of Petroleum (British). Journal
Institution of Gas Engineers. Bulletins, Communications and Transactions
Instruments

Jet Propulsion
Journal des Usines a Gaz
Journal of Applied Chemistry
Journal of Applied Mechanics
Journal of Applied Physics
Journal of Chemical Physics
Journal of Metals
Journal of Organic Chemistry
Journal of Petroleum Technology
Journal of Physical Chemistry
Journal of Research (National Bureau of Standards)
Journal of Scientific Instruments

Laboratory Practice
LP-Gas
Lubrication

Materials and Methods
Mathematical Aids
Mechanical Engineering
Mining Engineering

National Advisory Committee for Aeronautics, Reports
National Fire Protection Association Quarterly
National Gas Bulletin of Australia
National Petroleum News

Official Gazette of the U.S. Patent Office
Oil and Gas Journal

Petroleum
Petroleum Engineer
Petroleum Processing
Petroleum Refiner
Physics Today
Pipe Line Industry
Power
Producers Monthly
Public Utilities Fortnightly

Refrigerating Engineering
Review of Scientific Instruments
Revue Generale du Gaz
Rivista dei Combustibili

Science
Svenska Gasverksföreningens Månadsblad

U.S. Bureau of Mines, Bulletins, Information Circulars, Reports of Investigations and Technical Papers

World Oil
World Petroleum

THE GAS INDUSTRY'S OWN EDUCATIONAL AND RESEARCH FACILITY